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A versus F: The effects of implicit letter priming on cognitive performance

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Background. It has been proposed that motivational responses outside people's conscious awareness can be primed to affect academic performance. The current research focused on the relationship between primed evaluative letters (A and F), explicit and implicit achievement motivation, and cognitive performance.

Aim. Given the evaluative connotation associated with letter grades, we wanted to know if exposure to the letter A before a task could improve performance, and exposure to the letter F could impair performance. If such effects are found, we suspected that they may be rooted in implicit approach versus avoidance motivation, and occur without participants' awareness.

Sample. The current research was conducted at a large research university in the USA. Twenty-three undergraduates participated in Expt 1, 32 graduate students in Expt 2, and 76 undergraduates in Expt 3.

Method. Expts 1 and 2 were conducted in classroom settings, and Expt 3 in a laboratory. In Expt 1, participants were randomly assigned to either the A or F condition. The letter manipulation came in the form of an ostensible Test Bank ID code on the cover of an analogy test, which participants were prompted to view and write on each page of their test. Expt 2 followed a similar procedure but included the neutral letter J as a third condition to serve as a control. In Expt 3, participants' letter condition was presented in the form of an ostensible Subject ID code prior to an anagram test.

Results. Expts 1–3 demonstrated that exposure to the letter A enhances performance relative to the exposure to the letter F, whereas exposure to the letter F prior to an achievement task can impair performance. This effect was demonstrated using two different types of samples (undergraduate and graduate students), in two different experimental settings (classroom and laboratory), using two different types of achievement tasks (analogy and anagram), and using two different types of letter presentation (Test Bank ID and Subject ID). Results from the funnelled debriefing, self-report goals, and word-stem completion support our position that the effect of

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letter on academic performance takes place outside the conscious awareness of participants.

Conclusions. Our findings suggest that students are vulnerable to evaluative letters presented *before* a task, and support years of research highlighting the significant role that nonconscious processes play in achievement settings.

In school contexts, letters given as grades carry evaluative connotations regarding one's level of achievement. Years of these grading practices create learned associations between letter grades and the quality of one's work, giving powerful evaluative meaning to otherwise meaningless letters.[1] It is likely that students begin the self-reflective process upon receiving a certain letter grade. Either pride or shame may accompany the presentation of an A or F atop an assignment or in report card. Moreover, it seems reasonable to suggest that letter grades affect future effort and persistence. Students earning an F may be more likely to disengage and avoid similar tasks, whereas those earning an A may be more apt to approach similar tasks with vigour. Providing some empirical support for these claims, Crocker, Karpinski, Quinn, and Chase (2003) found that college students' self-esteem and affect increased on days they received good grades and decreased on days they received poor grades. Crocker *et al.* (2003) explain these results by emphasizing the significant meaning that letter grades have for students:

> In the lives of most college students, few events are as important as receiving grades for their course work. Although grades are intended to evaluate and communicate the level of a student's performance in a class and where that performance could be improved, for some students grades may be interpreted as revealing their value or worth as a human being . . . (p. 507).

Additional research has shown that competence feedback in the form of grades can significantly alter students' intrinsic motivation (Butler & Nisan, 1986), sustained motivation towards similar tasks (Maehr, 1976), adoption and regulation of achievement goals (Senko & Harackiewicz, 2005), and sense of self-worth (Robison-Awana, Kehle, & Jenson, 1986). What remains unknown are the potential positive or negative effects that letters carry with them beyond their intended purpose, to evaluate performance. While the effects of receiving certain letter grades *following* a task can affect students' well-being, self-concept, and motivation (Covington, 1992; Crocker *et al.*, 2003; Hoge & McSheffrey, 1990; Nisan, 1981), it may be that exposure to letters associated with success or failure (i.e. A or F) *prior* to an academic task may have an effect on academic attainment.

In the present work, we were interested in the effect of exposure to the letter A or F prior to cognitive performance. It is important to note, however, that we were not interested in providing explicit knowledge of one's past performance via a letter grade, but rather implicit exposure to evaluate letters that may cue nonconscious motivation. Within achievement contexts, all students are aware of the positive meaning of the letter A, and the negative meaning of the letter F. Given the evaluative connotation associated with letter grades, we wanted to know if exposure to the letter A before a task could improve performance, and exposure to the letter F could impair performance. If such effects are found, we suspected that they may be rooted in implicit approach versus avoidance motivation. Approach motivation, associated with deep cognitive processing (Elliot & McGregor, 2001), has consistently been identified as a positive predictor of academic achievement (see Elliot & Friedman, 2007), and thus we believe that exposure to the letter A before a cognitive exam would enhance performance. This hypothesis is based on previous research suggesting that approach motives (and hence performance) can be primed with success-oriented cues (Bargh, Gollwitzer, Lee-Chai, Barndollar, & Tröetschel, 2001). Avoidance motivation, however, has been shown to be deleterious to performance via increased cognitive and physiological arousal (Elliot, Maier, Moller, Friedman, & Meinhardt, 2007; Elliot & McGregor, 2001), and thus we believe that viewing the letter F prior to an exam would prime a motive to avoid failure and ultimately undermine performance. This hypothesis is based on research in educational settings that has primed avoidance motives via learned aversive stimuli, such as the colour red (Elliot, Maier, Binser, Friedman, & Pekrun, 2009; Elliot *et al.*, 2007). Finally, and similar to previous studies on implicit priming, our hypothesis is that these processes will occur outside of participants' conscious awareness. Below, we discuss results from empirical research suggesting that subtle cues in the academic environment can affect student performance, which also suggests that nonconscious approach or avoidance motivation may be, at least in part, responsible for this phenomenon.

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[1] *The current research was conducted in the USA; however, many European countries assign grades with numbers as opposed to letters. For example, Switzerland uses a grading scale of 1–5 with a five being the best possible grade. Germany uses this same five-point scale, but five represents the lowest grade. Herein, when we refer to letter grades, we are referring to the grading system in the USA in which A indicates the best grade and F indicates the worst grade.*

Implicit versus explicit motives

Human motives differ in the extent to which they are explicit (conscious) or implicit (nonconscious). Implicit motives '. . . automatically influence behaviour without conscious effort. They are like rules that guide behaviours that have been acquired on the basis of repeated affective experiences' (McClelland, Koestner, & Weinberger, 1989, pp. 698–699), whereas explicit motives are cognized at the time of activation and pursuit (Bandura, 1986, 1997). Much of contemporary psychology is concerned with the effects of both conscious and unconscious processes on everything from memory (Schacter, 1987), emotions (Lazarus, 1991), goal pursuits (Bargh & Chartrand, 1999), and academic performance (Elliot *et al.*, 2007). In academia, research has shown that subtle cues in the environment, such as numbers (DeMarree, Wheeler, & Petty, 2005), stereotypes (Steele & Aronson, 1995), positive words (Bargh *et al.*, 2001), and even colour (Elliot *et al.*, 2007) can significantly affect psychological processes and performance attainment without the student's conscious awareness. Some of these priming effects have been shown to be rooted in nonconscious approach or avoidance motivation (e.g. Elliot *et al.*, 2007).

Approach versus avoidance motivation

Research suggests that when students approach tasks with the aim to succeed they perform better than students striving to avoid failure (for reviews, see Elliot & Friedman, 2007; Elliot & Thrash, 2001; Moller & Elliot, 2006). Ironically, it appears that being overly concerned with not performing poorly on a task often leads to the very poor performance one is trying to avoid. Elliot (1999) describes these distinct processes underlying performance motives:

> Approach and avoidance motivation differ as a function of *valence*: In approach motivation, behaviour is instigated or directed by a positive or desirable event or possibility, whereas in

> avoidance motivation, behaviour is instigated or directed by a negative or undesirable event or possibility (p. 170).

Approach–avoidance motivation often manifests itself in the form of academic goal pursuits. A goal to avoid failure often results in failure, whereas approaching tasks with the goal to perform well is more often associated with high achievement. The mechanisms responsible for these divergent effects are due in part to the cognitive and physiological indicators that accompany approach and avoidance goal pursuits. Approach goals in academic settings have been associated with deep cognitive processing whereas avoidance goals have been linked with increased cognitive and physiological test anxiety, fear of failure, and less effective self-regulatory strategies (Elliot & McGregor, 2001). Research in educational settings has shown that the academic context can induce students' approach or avoidance goal pursuits in the classroom. For example, when students perceive their teacher as emphasizing learning they report more approach goals, whereas an overt emphasis on evaluation has been associated with student accounts of avoidance goals (Church, Elliot, & Gable, 2001; Karabenick, 2004; Wolters, 2004). While this type of research supports the notion that students can self-report an explicit distinction between their own approach versus avoidance motives, such basic appetitive versus aversive strivings can also operate outside an individual's conscious awareness.

Priming nonconscious motivation

Bargh and colleagues have consistently shown through empirical research that much of a person's everyday choices, behaviours, and mental process are determined not only by conscious intentions, but also by subtle features of the environment (for a review, see Bargh & Chartrand, 1999). For example, multiple experiments have primed nonconscious achievement motivation in participants, motivation which then affected performance attainment (e.g. Bargh & Gollwitzer, 1994; Bargh *et al.*, 2001). Specifically, Bargh and colleagues hid achievement-related words (e.g. compete, succeed, strive, attain, achieve) within a word search puzzle. Participants exposed to the achievement words outperformed those exposed to neutral words on an array of intellectual tasks. Participants were unaware of the effect that the exposure to these loaded words had on their achievement motivation and subsequent performance attainment. Similar research has been successful in priming approach–avoidance behavioural patterns. Chen and Bargh (1999) found that priming participants with positive words subsequently resulted in the demonstration of implicit approach motivation in that primed participants more quickly pulled a lever towards themselves, whereas exposure to negative and failure-oriented words prompted avoidance behaviour in the form of rapidly pushing the lever away from themselves. Similarly, and focusing on achievement contexts, Elliot *et al.* (2009) primed avoidance behaviour by exposing participants to the colour red. Subjects exposed to the colour red on the cover of an ostensible analogy test moved their bodies (to a greater degree) away from the test compared to those shown the colour green or grey.

Elliot and colleagues have also found consistent effects of exposure to red on academic attainment. Across six experiments, Elliot *et al.* (2007) showed that brief exposure to the colour red (as opposed to green, blue, or an array of neutral colours) significantly impaired performance on measures of verbal and quantitative intelligence. Colours were presented to participants in the form of either the cover page of the test, or the participant's ID code. In each experiment, and following the colour manipulation, no effect of colour condition on self-reported (explicit) approach and avoidance goals was found. However, subjects exposed to the colour red showed implicit avoidance motivation as measured via behavioural (i.e. task choice) and psychophysiological (i.e. cortical activation) measures. Elliot *et al.* (2007) surmised that exposure to the colour red primed avoidance motivation that undermined academic performance, a process that occurred outside of participants' conscious awareness. The effect of red on nonconscious avoidance motivation was demonstrated in laboratory and classroom settings, in college and high school students, and in both Germans and Americans (see also Elliot & Maier, 2007). If a seemingly benign aspect of the classroom environment, such as colour, can induce avoidance motivation in an automatic fashion, it may be that exposure to evaluative letters may have similar effects.

The current research

Three experiments were conducted to test the hypothesis that letters typically used to evaluate student performance (i.e. A and F), when presented prior to an achievement task (verbal intelligence), may affect performance. We believed that this effect would be rooted in approach–avoidance motivation, and occur outside the conscious awareness of the individual. Specifically, we suspected that exposure to the letter A *prior to* an achievement test would prime nonconscious approach motivation to do well on the task, and enhance performance. Alternatively, those initially exposed to the letter F would unknowingly strive to avoid doing poorly on the task; a motive that would enervate performance. Finally, we hypothesized that individuals' self-reported approach and avoidance motivation would be unrelated to exposure to letter prime and, furthermore, that participants would not be aware that exposure to A or F affected their performance (Expts 1–3). In addition to self-report measures, we also examined the link between the letter prime and motivation with a task that does not require participants to be consciously aware of activated motivational processes (Expt 3).

EXPERIMENT 1

In Expt 1, we examined the effect of letter on analogy performance in a sample of undergraduate college students at a large research university in the mid-west. We chose to use the letters A and F as A is associated with achievement and F is associated with failure in academic contexts. Given the connotations associated with each letter, we hypothesized that exposure to the letter A would result in greater performance on a task of verbal intelligence.

Method

Participants

Twenty-three (9 male and 14 female) US undergraduates in single section of a social psychology class participated in the experiment. The mean age of participants was 20.91 years old ($SD = 1.20$) with a range of 18–23 years. No incentive was offered for participation.

Design and procedure

Participants were randomly assigned to either the A or F condition. Analogy performance served as the dependent variable. General ability (i.e. scores on the ACT test, an American college entrance exam that is somewhat analogous to the A-Level exam in the UK), pre-manipulation analogy performance (i.e. scores on practice test), and sex were used as covariates since all of these variables have affected performance in prior experimental work on achievement motivation (Bergin, 1995; Elliot *et al.*, 2007; Elliot, Shell, Henry, & Maier, 2005). Participants were tested as a group at the beginning of class. The experimenter remained blind to the letter condition assigned to students. In this, and all experiments, the general ability and demographic information was obtained from the participants at the end of the experiment.

Upon arrival for the experiment, 9 × 12 envelopes containing testing materials were randomly distributed and participants were informed that they were being invited to participate in a study of verbal intelligence that involved solving analogies. The experimenter then provided a verbal description of the analogy task. The task involved solving 15 moderately difficult analogies in 3.5 min. The analogies were selected from a published composition analogies (501 Word Analogy Questions, 2002) complete with difficulty ratings. A set of moderately difficult analogies were selected for the practice test, and a set of 15 comparably difficult analogies were selected for the real test (sample analogy: 18th Amendment is to prohibition as 19th Amendment is to . . .); four response options were provided, one of which best completed the pairing (in the sample, the response options were speech, suffrage, slavery, and arms; the solution was suffrage).

After the description of the task, participants were directed to the packet labelled practice analogies, which contained five pages with a staple in the upper left-hand corner. The first page of the packet was the cover page, followed by four pages containing three to four analogies each. Participants were read the following:

> An analogy is a statement in which two things are compared because they have something in common. Sometimes the two things are the same in some way, sometimes they are opposites. Below, you will find two sample analogies, along with the correct answers. Please take a moment to read the samples provided. Before you take the real test, you will first be able to practice some analogies. Each analogy has only one solution. This practice test does not count towards your official score, but we would still like you to try your very best. You will have 3.5 minutes to answer as many analogies as you can.

The experimenter started the stopwatch and moved to the corner of the room while participants complete the practice test. When the 3.5 min had elapsed, participants were instructed to return the practice test to their envelope and locate the packet labelled analogy test. The real analogy test appeared similar in composition to the practice test; however, the cover page of the real test displayed the letter manipulation in the upper right-hand corner of the cover page in the form of a Test Bank ID code (e.g. Test Bank ID: A; Test Bank ID: F). Test Bank ID appeared in 14-point font and the letter in 22-point. Using Test Bank ID to introduce the letter manipulation is amenable to a group setting in which more than one participant could share the same version of a test. Moreover, it is a common practice by instructors to use different versions of the same test. Each participant received the same analogy test. Participants were informed that they would be receiving feedback on this test, and that there are several versions of the 15 item analogy test. Participants were read the following:

> There are several different versions of the 15 item analogy test. The set of analogies assigned to you is indicated by your *Test Bank ID Code*, which is in the top right-hand corner the page. Please locate your ID now. So that we can match up your materials at a later date, please take a moment to write your Test Bank ID Code on the next four pages in the top right-hand corner of each page (where indicated).

In the top right-hand corner of each subsequent page of packet, Test Bank ID appeared in the same placement as on the cover page, followed by an underlined blank space. Participants were instructed to copy their Test Bank ID by folding back the top right-hand corner of each page (as to not look at the analogies), and then return to the cover page. Participants wrote their Test Bank ID a total of four times.

Following the letter manipulation, participants were informed that before taking the analogy test they were to locate the page in their envelope labelled Goals. The page contained approach and avoidance goal items in reference to the real analogy test. Participants completed the goal questionnaire before being directed back to the cover page of the analogy task. The experimenter started a stopwatch and moved to the front corner of the classroom while participants complete the test. When 3.5 min had elapsed, the experimenter announced that time had expired. Participants were instructed to return the analogy test to their envelope and were directed to the packet in their envelope labelled Participant Information, which contained four pages. The first page was demographic information, following by three pages of funnelled debriefing. Participants complete a brief demographic questionnaire followed by a written funnelled debriefing also amenable to the group setting (page 2 of packet: 'What do you think we were trying to test?'; page 3 of packet: 'If you mentioned *letter*, or *Test Bank ID Code*, in your response to question #1, do you have any guesses about what the purpose of the *letter* or *Test Bank ID* might have been in the study?'; page 3: 'What was your Test Bank ID Code?'). Next, students were informed that the experiment was over and were fully debriefed. Regarding feedback, participants were emailed the number of analogies they answered correctly and were told that this represented a very good performance.

Measures

Explicit motivation via achievement goals

Cognized achievement goals were measured using select approach and avoidance items from Cury, Elliot, Da Fonseca, and Moller (2006) and Elliot and McGregor (2001), and were modified slightly to be task-specific.[2] Mastery–approach goals (three items; e.g. 'My goal is to perform well on the analogy task'; $\alpha = .80$), and mastery–avoidance goals (three items; e.g. 'I just want to avoid doing poorly on the analogy task'; $\alpha = .68$), were assessed (scale of 1 = *not at all true of me* to 7 = *very true of me*).

Results

Awareness of letter and purpose of experiment

All 23 participants were able to accurately recall and report their Test Bank ID code, indicating that participants were indeed cognizant of their letter condition. Also, in the written funnelled debriefing, not a single participant guessed that either letter or Test Bank ID had anything to do with the experiment.

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[2] *Approach–avoidance forms of mastery goals, rather than performance goals, were used in Expts 1–3 as we were interested in participants' self- and task-referenced goals for an achievement task. According to the 2 × 2 achievement goal framework, mastery goals are strivings to either approach intrapersonal competence or avoid intrapersonal incompetence (Elliot, 1999; Elliot & McGregor, 2001), whereas performance goals are always norm-referenced. In all three experiments, participants were informed they would receive feedback on their own performance, and were not given an opportunity to learn about their performance relative to others. Thus, participants' motivation to outperform others (performance–approach), or avoid performing worse than others (performance–avoidance), was irrelevant to the current study.*

Analyses on analogy performance

A unifactorial (letter condition: A vs. F) between-subjects analysis of covariance (ANCOVA) was conducted on analogy performance ($M = 10.09$, $SD = 2.26$), with general ability (i.e. ACT scores; $M = 26.57$, $SD = 3.25$), pre-manipulation analogy performance ($M = 10.17$, $SD = 1.83$), and sex as covariates. Levene's test for equality of variances indicated no violation, $F = 1.08$, $p > .05$. The analysis revealed a significant effect of letter condition on analogy performance, $F(1, 18) = 4.34$, $p = .05$, partial $\eta^2 = .19$, indicating that participants in the A condition ($M = 11.08$, $SE = 0.55$) performed significantly better than those in the F condition ($M = 9.42$, $SE = 0.57$). See Figure 1 for means by letter condition.

Analyses on approach and avoidance achievement goals

Achievement goals were measured after the practice test and after the letter manipulation, but before the analogy test. Thus, it was plausible that performance on the practice test could affect achievement goals. In order to isolate the effect of letter manipulation, we controlled for the effect of practice test for this and all subsequent experiments. Two ANCOVAs, with performance on the practice test as a covariate, failed to yield a significant effect of letter condition on mastery-approach goals, $F = 2.24$, $p > .05$, or on mastery-avoidance goals, $F = 0.52$, $p > .05$.

Discussion

In sum, the results from this experiment supported our hypotheses. Participants who were prompted to write the letter A (in the form of a Test Bank ID code) on each page of an analogy test, prior to taking the test, performed significantly better than participants prompted to write the letter F on each page of the test. There was no effect of letter condition on both explicit approach and avoidance achievement goals for the analogy task. These findings lend support to our assumption that the observed effect of evaluative letters on performance attainment is not grounded in consciously accessible processes.

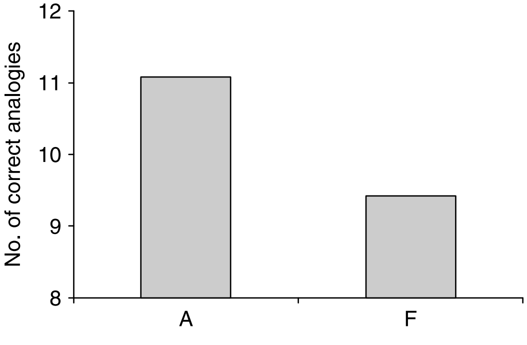

Figure 1. The effect of letter on analogy test performance in Expt 1: Mean number of correct analogies by letter of participants' Test Bank ID (adjusted for pre-manipulation analogy performance, general ability, and sex). Participants in the A condition ($N = 12$) performed significantly better than those in the F condition ($N = 11$).

EXPERIMENT 2

In Expt 2, we used the same analogy test as in Expt 1 but added a control group (i.e. the letter J). The letter J has no meaning in achievement contexts, thus we expected participants in the J condition would perform in between those in the A and F conditions. Specifically, we hypothesized that participants in the A condition would perform the best, with those in the J condition performing somewhat worse, and those in the F condition performing the worst of the three conditions.

Method

Participants

Thirty-two (10 male and 22 female) US graduate students at a large research university in the Midwest, across three separate research methods classes, participated in this experiment. The mean age of participants was 32.09 years old ($SD = 7.31$) with a range of 22–50 years. No incentive was offered for participation.

Design and procedure

Participants were randomly assigned to one of three between-subjects experimental conditions: the A condition, the F condition, or the J (neutral) condition. Analogy performance served as the dependent measure. Sex, age, and pre-manipulation analogy performance were used as covariates. ACT scores were not included as a covariate in this study as they were difficult to obtain from older participants. Many of the participants either did not take the ACT or took an analogous exam. Age was included as a covariate due to the large variation in the ages of the participating graduate students, as well as the documented effect of age on cognitive performance (e.g. Bäckman *et al.*, 2000; Lindenberger *et al.*, 2008).

The procedure of this experiment was similar to the previous experiment, with four exceptions. First, the experiment took place in three graduate classrooms. Participants were randomly assigned to a condition within each of the three classes, so that each of the three conditions was represented in each of the three classrooms. Second, participants were given 60 s to answer 10 analogies for the practice test and 1.5 min to answer 15 analogies for the real test (as opposed to 3.5 min for 15). This particular change was made given the restricted amount of class time provided for the experiment, and the assumption that graduate students would need less time than undergraduates to answer the same analogies. The first 10 analogies from the practice test used in Expt 1 were used for the practice test in this experiment. Despite being given less time on the practice test, participants were given the same ratio of time to answer each analogy. The final distinction between the current and previous experiments was the addition of the control group J (also appearing as a form designation for the Test Bank).

Following the same letter manipulation procedure used in Study 1, participants completed the achievement goal items in reference to the analogy task before being directed back to the analogy test. At the completion of the analogy test, participants completed a written funnelled debriefing, were informed that the experiment was over, and were fully debriefed. Regarding feedback, participants were emailed the number of analogies they answered correctly and were told that this represented a very good performance.

Measures

Explicit motivation via achievement goals

To reduce time spent in the participating classrooms, fewer items were used. A single item was selected from Expt 1 to measure mastery–approach goals, and two items from Expt 1 were used to measure mastery–avoidance goals ($\alpha = .58$). Again, participants responded on a scale of 1 (*not at all true of me*) to 7 (*very true of me*).

Results

Awareness of letter and purpose of experiment

All 32 participants were able to accurately recall and report their Test Bank ID code, indicating that participants were indeed cognizant of their letter. In the written funnelled debriefing, however, not a single participant guessed that either letter or Test Bank ID had anything to do with the experiment.

Analyses on analogy performance

A unifactorial (letter condition: A vs. J vs. F) between-subjects ANCOVA was conducted on analogy performance ($M = 7.94$, $SD = 3.63$), with pre-manipulation analogy performance ($M = 4.28$, $SD = 2.04$), age ($M = 32.09$, $SD = 7.31$), and sex as covariates. To test our hypothesis in this experiment, we ran planned comparisons (Fisher's least significant difference) following the omnibus analysis. Levene's test for equality of variances indicated no violation, $F = 0.76$, $p > .05$.The analysis revealed a significant effect of letter condition on analogy performance, $F(2, 26) = 3.87$, $p < .05$, partial $\eta^2 = .23$. Pairwise comparisons revealed that participants in the A condition ($M = 9.64$, $SE = 0.81$) performed significantly better than those in the F condition ($M = 6.29$, $SE = 0.86$) at $p < .05$. Participants in the J condition ($M = 8.17$, $SE = 0.91$) performed better than those in the F condition and worse than those in the A condition, but these differences were not statistically significant. See Figure 2 for means by letter condition.

Analyses on approach and avoidance achievement goals

Two ANCOVAs, with performance on the practice test as a covariate, failed to yield a significant effect of letter condition on mastery–approach goals, $F = 1.10$, $p > .05$, or on mastery–avoidance goals, $F = 1.11$, $p > .05$.

Discussion

In sum, the results from this experiment replicated those of Expt 1 while also including a neutral letter condition (i.e. J), and using an alternative sample made up of graduate students. Again, participants who were prompted to write the letter A (in the form of a Test Bank ID code) on each page of an analogy test, prior to taking the test, performed significantly better than participants prompted to write the letter F on each page of the test; participants prompted to write the letter J performed in between participants in the A and F conditions. There was again no effect of letter condition on explicit approach and avoidance achievement goals for the analogy task.

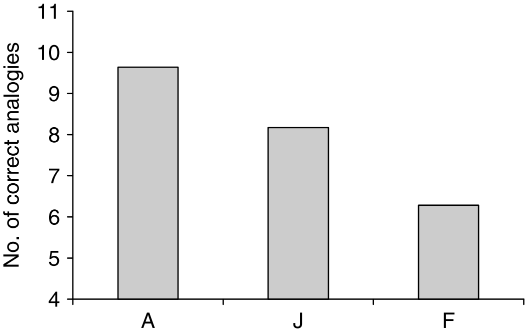

Figure 2. The effect of letter on analogy test performance in Expt 2: Mean number of correct analogies by letter of participants' Test Bank ID (adjusted for pre-manipulation analogy performance, sex, and age). Participants in the A condition ($N = 11$) performed significantly better than those in the F condition ($N = 10$). Participants in the J condition ($N = 11$) did not differ significantly from those in either the A or F condition.

EXPERIMENT 3

To establish generalizability to a different measure of cognitive performance, in Expt 3 we changed the dependent variable from an analogy test to an anagram test, and conducted the experiment in a laboratory setting. Once again, we used the letter J as a control group hypothesized to perform better than those in the F condition but worse than those in the A condition. As Expts 1 and 2 showed no effects of letter condition on explicit approach or avoidance motivation via participants' self-reported achievement goals, Expt 3 included a word-stem completion task as a measure of implicit achievement motivation. We hypothesized that implicit achievement motivation would be higher in the A versus F condition.

Method

Participants

Seventy-six (34 male and 42 female) US undergraduate psychology students at a large research university in the Midwest participated in the experiment for course credit. The mean age of participants was 19.14 ($SD = 0.92$) years old with a range of 18–23 years.

Design and procedure

Participants were randomly assigned to one of three experimental conditions: the A condition, the F condition, or the J (neutral) condition. Anagram performance served as the dependent measure. Analogous to Expt 1, general ability (i.e. ACT scores), pre-manipulation anagram performance (i.e. scores on practice test), and sex were used as covariates. Similar to Expts 1 and 2, the procedure was designed to ensure that the experimenter did not see the manipulated letter at any time during the experiment. Participants were tested either individually or in groups of either two or three. When more than a single participant was being tested, each was stationed at opposite corners of the lab.

Upon arrival to the laboratory for the experiment, participants were informed they would be partaking in a study of verbal intelligence. The procedure for the rest of the experiment was the similar to that of Expts 1 and 2 with three exceptions. First, and to generalize the effects of the letter manipulation to a somewhat different context, the experiment was conducted in a laboratory as opposed to a classroom setting. Second, the experimental task was a set of 15 moderately difficult anagrams, and the practice test a set of 15 comparably difficult anagrams (sample anagram: *YNAHE*; solution: *HYENA*). Both the practice anagram test and the real anagram test used in this experiment have been used in similar research (i.e. Expt 1; Elliot *et al.*, 2007), and originated from a published list of single solution, five-letter anagrams (Gilhooly, 1978). Third, the letter manipulation was presented in the form of Subject ID code rather than a test form designation. This method was more amenable to the laboratory setting, as it is a common practice in research to assign a code to each participant.

After the description of the task, participants were directed to the packet in their envelope labelled practice anagrams, which was six pages long with a staple in the upper left-hand corner. The first page of the packet was the cover page, followed by five pages containing three anagrams each. Participants were read the following:

> Each anagram consists of scrambled letters. To solve the anagram, you rearrange the letters to form a word. The anagrams will be listed in the column on the left, and you put the solutions in the space on the right. Each anagram has only one solution, and all the solutions are common English words. This practice section doesn't count towards your official score, but we would still like you to try your very best. You will have 5 minutes to solve as many anagrams as you can.

The experimenter started the stop-watch and moved to the rear of the laboratory during the practice test. When the 5 min had elapsed, participants were instructed to return the practice test to their envelope and locate the packet labelled Anagram Test. The real test which was similar in composition to the practice test; however, the cover page of the real test displayed the letter manipulation in the upper right-hand corner of the page in the form of a Subject ID code (e.g. Subject ID: A; Subject ID: F; Subject ID: J). Subject ID appeared in 14-point font and the letter in 22-point. Participants were informed that they would be receiving feedback on this test, reread the instructions for solving anagrams, and read the following:

> In the top right-hand corner of the cover page you fill find your Subject Identification Code. When the experiment is over, we will be separating the pages. So that we can match up pages at a later date, please write your Subject ID Code in the top right-hand corner of the next *five* pages (where indicated). Please do not look at the anagrams while you do this.

In the top right-hand corner of each subsequent page of the packet, Subject ID appeared in the same placement as on the cover page, only following by an underlined blank space. Participants were instructed to copy their Subject ID by folding back the top right-hand corner of each page (as to not look at the anagrams), and then return to the cover page. Participants wrote their Subject ID a total of five times. Remaining blind to the letter condition, the experimenter remained in the rear of the laboratory at all times.

Following the letter prime, participants were informed that before taking the anagram test they were to locate the page in their envelope labelled word completion task (described below). The instructions read:

> The page in front of you lists incomplete words. Please fill in the blank or blanks to form a word. In this case, there is more than one possible solution for each word – Just pick the one that jumps out at you first.

Following the word completion task, students completed the explicit goal questionnaire before being directed back to the cover page of the anagram task. The experimenter started a stop-watch and moved to the rear of the laboratory while participants complete the test. When 5 min had elapsed, the experimenter announced that time had expired and participants were directed to return the anagram test to their envelope and locate the packet labelled Participant Information, which contained four pages. The first page was demographic information, following by three pages of funnelled debriefing. All participants completed a written funnelled debriefing in case more than one participant was present in the laboratory (page 2 of packet: 'What do you think we were trying to test?'; page 3 of packet: 'If you mentioned *letter*, or *Subject ID Code*, in your response to question #1, do you have any guesses about what the purpose of the *letter* or *Subject ID Code* might have been in the study?'; page 3: 'What was your Subject ID Code?'). While participants completed this information, the experimenter graded the anagram task. All participants were informed of the number of anagrams that they solved correctly and were told that this represented a very good performance. Next, students were informed that the experiment was over, fully debriefed, and dismissed.

Measures

Explicit motivation via achievement goals

The same achievement goal items used in Expt 1 (modified to the anagram test) were used to measure mastery–approach goals (three items; e.g. 'My goal is to perform well on the anagram task'; $\alpha = .84$), and mastery–avoidance goals (three items; e.g. 'I just want to avoid doing poorly on the anagram task'; $\alpha = .61$). Again, participants responded on a scale of 1 (*not at all true of me*) to 7 (*very true of me*).

Implicit motivation via word completion task

One method to expose nonconscious processes is to present subjects with incomplete words that can be completed as either neutral or in a particular way (e.g. DeWall & Baumeister, 2007). After the letter manipulation, subjects completed a word-stem completion task, in which they formed words that could be completed as either achievement-oriented or neutral. In addition to three incomplete filler words that could not be complete as achievement-oriented (i.e. *ea_*, *do_*, *pi_*), we included three incomplete words (i.e. *ac_*, *pas_*, *wi_*) that could be completed as either achievement-oriented (i.e. *ace*, *pass*, *win*) or as neutral (e.g. *act*, *past*, *wig*).

Results

Awareness of letter and purpose of experiment

All 76 participants were able to accurately recall and report their Subject ID code, indicating that participants were indeed cognizant of their letter. In the written funnelled debriefing, however, not a single participant guessed that either letter or Subject ID had anything to do with the experiment.

Analyses on anagram performance

A unifactorial (letter condition: A vs. J vs. F) between-subjects ANCOVA was conducted on anagram performance ($M = 4.83$, $SD = 2.54$), with general ability (i.e. ACT scores;

$M = 25.63$, $SD = 3.36$), pre-manipulation anagram performance ($M = 4.21$, $SD = 2.36$), and sex as covariates. To test our hypothesis in this experiment, we ran planned comparisons (Fisher's least significant difference) following the omnibus analysis. Levene's test for equality of variances indicated no violation, $F = 2.23, p > .05$. The analysis revealed a significant effect of letter condition on anagram performance, $F(2, 70) = 9.50$, $p < .001$, partial $\eta^2 = .21$. Pairwise comparisons revealed that participants in the A condition ($M = 6.02$, $SE = 0.39$) solved significantly more anagrams than those in the J condition ($M = 4.76$, $SE = 0.40$) at $p < .05$, and participants in the F condition ($M = 3.65$, $SE = 0.39$) at $p < .001$.Participants in the J condition solved significantly more anagrams than those in the F condition at $p = .05$. See Figure 3 for means by letter condition.

Analyses on approach and avoidance achievement goals

Two ANCOVAs, with performance on the practice test as a covariate, again yielded no significant effect of a letter condition on mastery-approach goals, $F = 0.65$, $p > .05$, or on mastery-avoidance goals, $F = 0.52$, $p > .05$.

Analyses on success-oriented word completion task

A unifactorial (letter condition: A vs. J vs. F) between-subjects ANCOVA was conducted on the number of words completed as achievement-oriented ($M = 1.67$, $SD = 0.90$), with pre-manipulation anagram performance as a covariate. Results yielded a significant effect of letter condition, $F = 3.16, p < .05$, partial $\eta^2 = .08$, on achievement-oriented words. Pairwise comparisons revealed that participants in the A condition ($M = 1.99$; $SE = 0.17$) completed significantly more of the three possible words as achievement-oriented compared to participants in the F condition ($M = 1.37$; $SE = 0.17$), at $p < .05$. Participants in the J condition ($M = 1.64$, $SE = 0.18$) completed more words as achievement-oriented than those in the F condition and less than those in the A condition, but these differences were not significant. Performance on the practice test had a null effect. See Figure 4 for the mean number of words completed as achievement-oriented by letter condition.

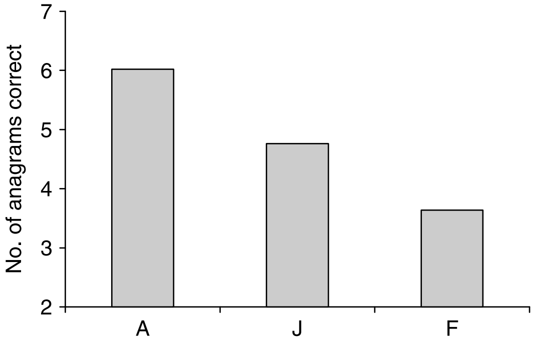

Figure 3. The effect of letter on anagram test performance in Expt 3: Mean number of correctly solved anagrams by letter of participants' Subject ID (adjusted for pre-manipulation analogy performance, general ability, and sex). Participants in the A condition ($N = 26$) solved significantly more anagrams correctly than those in both the J condition ($N = 24$) and the F condition ($N = 26$). Participants in the J condition solved significantly more anagrams correct than those in both the F condition.

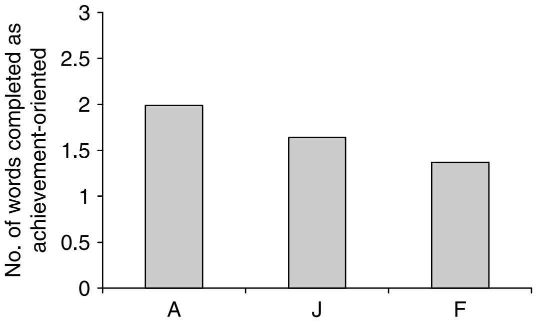

Figure 4. The effect of letter on word completion task in Expt 3: Mean number of word stems (i.e. *ac_*, *pas_*, *wi_*) completed as achievement-oriented (i.e. *ace*, *pass*, *win*). Participants in the A condition ($N = 26$) generated significantly more achievement-oriented words than those in the F condition ($N = 26$).

Discussion

In sum, the results from this experiment replicated those of Expts 1 and 2, using a different presentation of the letter manipulation (i.e. Subject ID), using a different task (i.e. anagram performance), and a different experimental setting (i.e. lab), and also introduced a measure of implicit motivation (i.e. achievement word completion task). Participants who were prompted to write the letter A (in the form of Subject ID code) on each page of an anagram test, prior to taking the test, performed significantly better than participants prompted to write the letter F on each page of the test; participants in the J (neutral) condition performed in between participants in the A and F conditions (significantly below A but above F). There was again no effect of letter condition on both self-reported approach and avoidance goals for the anagram task; however, participants in the A condition generated significantly more achievement-oriented words in the implicit achievement motivation measure than participants in the F condition. Taken as a whole, the results again support our proposal that the observed effects are not grounded in consciously accessible processes and that participants are not aware of the influence that letter has on their performance.

GENERAL DISCUSSION

The results from these three experiments provide clear support for the hypothesized effect of the letters A and F on academic performance. Although prior research has shown that receiving letter grades *after* performance can affect future performance, no prior research has shown a letter effect when people are exposed to letters *prior* to performance. Expts 1–3 demonstrated that exposure to the letter A enhances performance relative to the exposure to the letter F, whereas exposure to the letter F prior to an achievement task can impair performance. This effect was demonstrated using two different types of samples (undergraduate and graduate students), in two different experimental settings (classroom and laboratory), using two different types of verbal achievement tasks (analogy and anagram), and using two different types of letter presentation (Test Bank ID and Subject ID). Results from the funnelled debriefing, self-report mastery goals, and word-stem completion support our position that the effect of letter on academic performance takes place outside the conscious awareness of participants.

Two of our three experiments took place in actual classroom settings, and used a method common to instructors to manipulate letter condition (i.e. Test Bank ID). The primary practical implication from our research, we believe, is that teachers should be careful not to use identification systems that map on to assessment systems. In an effort to reduce the likelihood of cheating, professors often use different versions of a test, which are often presented to students in the form of different letters to be bubbled in on the scan form. In a course with letter grading, teachers should avoid identifying different test forms using letters from the grading scale (i.e. use W–X–Y–Z, not A–B–C–D). When A–B–C–D is used, this may inadvertently prime students to do better or worse than their ability and preparation would predict – essentially introducing a confound into the testing process. Another implication from the current study is that teachers may find it worthwhile to adorn their classrooms with symbols of achievement, such as A + and other success-oriented words and phrases. Using achievement-related primes in the classroom may activate effort, pride, and the intention to perform well. Perhaps, savvy teachers might use this effect to help their entire class do better in a standardized testing situation. Results from previous research provide some support for this assumption, as participants exposed to achievement-related words hidden in a word search puzzle subsequently outperform those exposed to neutral letters on an intellectual task (Bargh *et al.*, 2001). It should be noted, however, that the external validity of our study remains to be demonstrated.

There were limitations to the current research worth noting. First, the mastery–avoidance measures used in Expts 1–3 demonstrated a low reliability. Mastery–avoidance goals are a fairly new construct, and have received little empirical scrutiny. Some researchers suggest that items measuring mastery–avoidance goals are conceptually problematic and prone to being misinterpreted (Ciani & Sheldon, 2009; Easter, Ciani, & Summers, 2007, 2008; Hulleman, Trinastic, & Harackiewicz, 2006; Pintrich, 2000), an issue that may have contributed to the low reliabilities in the current research. Additionally, we only used a few items to assess mastery–avoidance goals, which can also have an undesirable effect on the internal consistency of a measure. With time, more widely used and validated measures of mastery–avoidance goals will become available. Another limitation to the current research is using only one indicator of implicit achievement motivation via the word completion task in Expt 3. In similar research, Easter *et al.* (2007) have used risk taking measures and even activity in the frontal cortex measured by electroencephalogram (EEG) to assess nonconscious avoidance motivation, while others (Chen & Bargh, 1999) used subjects' propensity to push a lever away from their bodies as a measure of avoidance motivation. More measures of nonconscious motivation should be incorporated into future research in this area. Doing so will provide researchers with the ability to identify the specific mediating properties of implicit motivation that are hypothesized to be responsible for the effects of the letter primes on performance.

The powerful meaning of evaluative letters in achievement contexts has become a prominent issue in US educational policy. In 2008, an entire school district in Adams county Colorado passed a moratorium on assigning letter grades, and instead now uses a series of criterion-referenced levels in each course. It is also worth noting that many prestigious universities in the USA opt to use E rather than F to represent failure. Just a few of these institutions that do not use the letter F include the University of Florida, University of Arizona, University of Michigan, Harvard University, and Stanford University. While many of these grading policies are long-standing, many have been revised somewhat recently. If academic institutions at all levels are moving away from using the letter F, presumably because of the overt negative connotation associated with it and the negative effect that it can have on students' state of mind (Crocker *et al.*, 2003), it would be interesting to examine the effect that E and F have on students attending these institutions. For example, it may be that the exposure to the letter A prior to an achievement task can still enhance performance; however, the letter F may not have the same failure-oriented association in these contexts. It may be that exposure to the letter E, in institutions that assign E as the lowest grade, will produce a similar effect as the letter F did in our study (which was conducted at a university that uses the traditional A–B–C–D–F grading scale). Thus, changing the lowest grade from F to E, or any other letter, may only serve as a temporary stop-gap approach to the problem; once students acquire associations regarding the new 'failure' designation, we would expect the effects to return.

Yet another issue that should be addressed in future research is the possibly interplay between letter and colour. Elliot *et al.* (2007) demonstrated that viewing the colour red just prior to an achievement task impaired performance. The process by which red impaired performance in Elliot's research is analogous to our assumption that exposure to the letter F would prime implicit avoidance motivation, thus undermining performance. Elliot underscored both the biological (e.g. sexual readiness) and cultural (e.g. stop signs) meaning of red, with more emphasis on the latter to explain his findings in an achievement context. Specifically, Elliot noted that common use of red ink to grade may have led to its ability to evoke avoidance motivation in participants. In our study, it was presumed that the meaning of A and F in an achievement context is the results of years of pairings and resultant learned associations, without reference to colour. We believe that exposure to red may evoke the same set of related concepts on an individual's semantic memory as does the letter F. However, Elliot was unable to identify a colour that could enhance performance above and beyond a series of achromatic colours (black, white, and grey). In our study (Expts 2 and 3), expose to the letter A did enhance performance over both the control group (J condition) and those in the F condition. Future research may seek to examine the dual and integrative effects of both letter and colour on performance. For example, it may be that viewing the colour gold may enhance performance as gold is associated with gold stars given for excellent performance. Moreover, it would be interesting to know if A and F retain their effects if both were presented to participants in the colour red. We suspect that the letter A might undo the negative effects of the colour red, or perhaps red might undo the positive effects of A.

Another implication of our finding is that the effects of letter priming are inaccessible to awareness, both in that participants were not aware of the prime itself and also in that the prime did not affect self-reported explicit motivation. We believe the effects observed in the current research are a result of nonconscious approach and avoidance achievement goal strivings, and the non-effect of letter priming on explicit achievement goals has implications for motivation research in general. Specifically, there seems to be an over-reliance in the literature on self-reported motivational states. Thus, there remains the question, 'when can students self-report motivational states, and when do these processes occur at a nonconscious level?' The current research found a non-effect of letter priming on participants' explicit approach and avoidance achievement goals using a measure that is quite common among social cognitive theorists (Elliot, 1999). Given findings that not all approach and avoidance achievement goals are consciously accessible (e.g. Elliot *et al.*, 2007), it may be advantageous for social cognitive theorists to measure motives by both implicit and explicit means.

Our study makes a contribution to the body of research on implicit achievement motivation by demonstrating that exposure to evaluative letters (A or F) *prior* to a task can either enhance or impair academic attainment. Our findings support years of research highlighting the significant role that nonconscious processes play in achievement settings. And while the current study is framed in approach–avoidance motivation, more research is needed to unearth the exact mechanism responsible for the effects of letter priming described herein. One alternative explanation may lie in active-self theory (DeMarree *et al.*, 2005; Wheeler, DeMarree, & Perry, 2007), which posits that different self-concepts (i.e. successful self vs. failure self) can be primed and activated such that people temporarily act in construct-consistent, stereo-typical ways. For example, studies have shown that priming participants with an elderly stereotype results in a slower gait in both the elderly and the young (Bargh, Chen, & Burrows, 1996; Hausdorff, Levy, & Wei, 1999). Additionally, Steele and Aronson (1995) demonstrated that Whites outperformed African-Americans on the Graduate Record Exam after being told the test was measuring intelligence, presumably activating a failure self-concept. No difference was observed in absence of the intelligence prime. A more recent study found that exposure to the number 7 (vs. 13) resulted in participants feeling lucky. It is important to note that the effects of the primes in the aforementioned studies also occurred outside participants' conscious awareness.

In the current research, it could be argued that active-self primes are responsible for the effects of letter priming on academic performance. That is, exposure to the letter A primes an implicit successful-self, which enhances performance. Alternatively, exposure to the letter F activates a failure-self prime that ultimately disengages the participant from any meaningful effort. The key difference between using active-self theory verses an approach–avoidance framework lies in the motivational strivings following the prime, especially for the F conditions. An active-self account of the effect of F on achievement would be that the participant internalizes failure, and disengages – whereas we posit that viewing F primes a strong motive to avoid failure. Expt 3 in the current research found that participants in the A condition (vs. the F condition) were more likely to form success-oriented words when presented with a word completion task. We believe that this finding provides some evidence for the presence of implicit approach motivation by participants in the A condition; however, it is difficult to determine if the lack of a preoccupation with success by participants in the F condition (as indicated by significantly less words completed as success-oriented) translates to avoidance motivation. According to active-self theory, it may be that participants in the A condition felt more successful going into the test, whereas those in the F condition were not. Future research on the effects of letter priming that include both explicit *and* implicit measures of motivation are needed; however, active-self theory may represent an alternative explanation for the effects of letter priming on cognitive performance.

In closing, evaluative letters are ubiquitous in academic settings, and it appears that certain originally innocuous letters may acquire evaluative meanings that can influence a person's performance – even before performance begins, and even outside of conscious awareness. In the current study, we were able to demonstrate that the letters A and F, when casually assigned to the student before a task begins, indeed influence student performance. This suggests that educators should be very careful in choosing their identification systems (test form, student identification), keeping them independent of the testing process, in order to avoid biasing the assessment of current academic achievement. Students designated as 'student F' or students receiving 'Test Form F' may be at an unfair disadvantage.

References

Bäckman, L., Ginovart, N., Dixon, R. A., Wahlin, T. B., Wahlin, A., Halldin, C., *et al.* (2000). Age-related cognitive deficits mediated by changes in the striatal dopamine system. *American Journal of Psychiatry*, *157*, 635–637.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W. H. Freeman.

Bargh, J. A., & Chartrand, T. L. (1999). The unbearable automaticity of being. *American Psychologist*, *54*, 462–479.

Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of Personality and Social Psychology*, *71*, 230–244.

Bargh, J. A., & Gollwitzer, P. M. (1994). Environmental control of goal-directed action: Automatic and strategic contingencies between situations and behavior. In W. D. Spaulding (Ed.), *Integrative views of motivation, cognition, and emotion. Nebraska symposium on motivation* (Vol. 41, pp. 71–124). Lincoln, NE: University of Nebraska Press.

Bargh, J. A., Gollwitzer, P. M., Lee-Chai, A. Y., Barndollar, K., & Tröetschel, R. (2001). The automated will: Nonconscious activation and pursuit of behavioral goals. *Journal of Personality and Social Psychology, 81*, 1014–1027.

Bergin, D. A. (1995). Effects of a mastery versus competitive motivation situation on learning. *Journal of Experimental Education*, *63*, 303–314.

Butler, R., & Nisan, M. (1986). Effects of no feedback, task-related comments, and grades on intrinsic motivation and performance. *Journal of Educational Psychology*, *78*, 210–216.

Chen, M., & Bargh, J. A. (1999). Consequences of automatic evaluation: Immediate behavioral predispositions to approach or avoid the stimulus. *Personality and Social Psychology Bulletin*, *25*, 215–224.

Church, M. A., Elliot, A. J., & Gable, S. L. (2001). Perceptions of classroom environment, achievement goals, and achievement outcomes. *Journal of Educational Psychology*, *93*, 43–54.

Ciani, K. D., & Sheldon, K. M. (2009). Evaluating the mastery–avoidance goal construct: A study of elite college baseball players. *Psychology of Sport and Exercise*. Advance online publication. doi: 10.1016/j.psychsport2009.04.005.

Covington, M. V. (1992). *Making the grade: A self-worth perspective on motivation and school reform*. New York: Cambridge University Press.

Crocker, J., Karpinski, A., Quinn, D. M., & Chase, S. (2003). When grades determine self-worth: Consequences of contingent self-worth for male and female engineering and psychology majors. *Journal of Personality and Social Psychology*, *85*, 507–516.

Cury, F., Elliot, A. J., Da Fonseca, D., & Moller, A. (2006). The social-cognitive model of achievement motivation and the 2 × 2 achievement goal framework. *Journal of Personality and Social Psychology*, *90*, 666–679.

DeMarree, K. G., Wheeler, S. C., & Petty, R. E. (2005). Priming a new identity: Effects of non-self stereotype primes and self-monitoring on the self-concept. *Journal of Personality and Social Psychology*, *89*, 657–671.

DeWall, C. N., & Baumeister, R. F. (2007). From terror to joy: Automatic tuning to positive affective information following mortality salience. *Psychological Science*, *18*, 984–990.

Easter, M. A., Ciani, K. D., & Summers, J. J. (2007, April). *Avoiding personal incompetence or merely a form of psychological distress? Evidence that mastery–avoidance may not be an achievement goal*. Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL.

Easter, M. A., Ciani, K. D., & Summers, J. J. (2008). *Conceptual and measurement dilemmas within the* 2 × 2 *achievement goal framework*. Paper presented at the annual meeting of the American Educational Research Association, New York.

Elliot, A. J. (1999). Approach and avoidance motivation and achievement goals. *Educational Psychologist*, *34*, 149–169.

Elliot, A. J., & Friedman, R. (2007). Approach–avoidance: A central characteristic of personal goals. In B. R. Little, K. Salmela-Aro, & S. D. Phillips (Eds.), *Personal project pursuit: Goals, action, and human flourishing* (pp. 97–118). Mahwah, NJ: Erlbaum.

Elliot, A. J., & Maier, M. A. (2007). Color and psychological functioning. *Current Directions in Psychological Science*, *16*, 250–254.

Elliot, A. J., Maier, M. A., Binser, M. J., Friedman, R., & Pekrun, R. (2009). The effect of red on avoidance behavior in achievement contexts. *Personality and Social Psychological Bulletin*, *35*, 365–375.

Elliot, A. J., Maier, M. A., Moller, A. C., Friedman, R., & Meinhardt, J. (2007). Color and psychological functioning: The effect of red on performance attainment. *Journal of Experimental Psychology: General*, *136*, 154–168.

Elliot, A. J., & McGregor, H. A. (2001). A 2 × 2 achievement goal framework. *Journal of Personality and Social Psychology*, *80*, 501–519.

Elliot, A. J., Shell, M. M., Henry, K., & Maier, M. (2005). Achievement goals, performance contingencies, and performance attainment: An experimental test. *Journal of Educational Psychology*, *97*, 630–640.

Elliot, A. J., & Thrash, T. M. (2001). Achievement goals and the hierarchical model of achievement motivation. *Educational Psychology Review*, *12*, 139–156.

Gilhooly, K. J. (1978). Bigram statistics for 205 five-letter words having single-solution anagrams. *Behavior Research Methods and Instrumentation*, *10*, 389–392.

Hausdorff, J. M., Levy, B. R., & Wei, J. Y. (1999). The power of ageism on physical function of older persons: Reversibility of age-related gait changes. *Journal of the American Geriatrics Society*, *47*, 1346–1349.

Hoge, R. D., & McSheffrey, R. (1990). An investigation of self-concept in gifted children. *Exceptional Children*, *57*, 238–245.

Hulleman, C. S., Trinastic, J. P., & Harackiewicz, J. M. (2006, April). *Approach and avoidance mastery goals in a learning context*. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Karabenick, S. A. (2004). Perceived achievement goal structure and college student help seeking. *Journal of Educational Psychology*, *96*, 569–581.

Lazarus, R. S. (1991). *Emotion and adaptation*. New York: Oxford University Press.

LearningExpress, LLC (2002). *501 word analogy questions*. New York: Author.

Lindenberger, U., Nagel, I. E., Chicherio, C., Li, S., Heekeren, H. R., & Bäckman, L. (2008). Age-related decline in brain resources modulates genetic effects on cognitive functioning. *Frontiers in Neuroscience*, *2*, 234–244.

Maehr, M. L. (1976). Continuing motivation: An analysis of a seldom considered educational outcome. *Review of Educational Research*, *46*, 443–462.

McClelland, D. C., Koestner, R., & Weinberger, J. (1989). How do self-attributed and implicit motives differ? *Psychological Review*, *96*, 690–702.

Moller, A. C., & Elliot, A. J. (2006). The 2 × 2 achievement goal framework: An overview of empirical research. In A. Mittel (Ed.), *Focus on educational psychology* (pp. 307–326). New York: Nova Science Publishers.

Nisan, M. (1981). Motivational aspects of evaluation in school. In I. A. Lewy & D. Nevo (Eds.), *Evaluation roles in education* (pp. 133–137). London: Gordon and Breach.

Pintrich, P. R. (2000). An achievement goal theory perspective on issues in motivation terminology, theory, and research. *Contemporary Educational Psychology*, *25*, 92–104.

Robison-Awana, P., Kehle, T. J., & Jenson, W. R. (1986). But what about smart girls? Adolescent self-esteem and sex role perceptions as a function of academic achievement. *Journal of Educational Psychology*, *78*, 179–183.

Schacter, D. L. (1987). Implicit memory: History and current status. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *13*, 501–518.

Senko, C., & Harackiewicz, J. M. (2005). Regulation of achievement goals: The role of competence feedback. *Journal of Educational Psychology*, *97*, 320–336.

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African-Americans. *Journal of Personality and Social Psychology*, *69*, 797–811.

Wheeler, S. C., DeMarree, K. G., & Petty, R. E. (2007). Understanding the role of the self in prime to behavior effects: The active-self account. *Personality and Social Psychology Review*, *11*, 234–261.

Wolters, C. A. (2004). Advancing achievement goal theory: Using goal structures and goal orientations to predict students' motivation, cognition, and achievement. *Journal of Educational Psychology*, *96*, 236–250.

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